WING ASSEMBLIES FOR AIRCRAFT

BACKGROUND OF THE INVENTION

A variant of my US Patents 4,577,815 or 5,984,230 shows a rotary wing having a spar that flexes and crosses the axis of the spar in two or more points, without transmission of flexural movement to the wing sheets.
The spar mounts one or more flying surfaces extending spanwise and rotatable about said spar about the longitudinal axis of said spar.

SUMMARY OF THE INVENTION

The present invention relates to a wing assembly in which axial rotation from engine power can be transmitted to the wing sheets of the above mentioned type. In this assembly the engine transmits power to the surface of the wing sheets without transmitting it to the framework, through a structure independent from the wing framework, without interfering with the relative movement between the wing sheets and the frame.

BRIEF DESCRIPTION OF THE INVENTION

The invention is illustrated, by way of example, in the accompanying drawings in which :

Fig. 1 is a side elevation of an embodiment of a wing with a power transmission assembly, shown in rotary motion about its spar.

Fig. 2 is a detail of Fig. 1

Fig. 3 is a sectional elevation of the assembly along the line I-I of Fig. 1

Fig.4 is a sectional elevation of the assembly along the line M of Fig. 1

Fig. 5 is a plan view of the assembly shown in a modified construction.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings an aircraft fuselage (not shown) has an edge along the line F of Fig. 1 and carries a tubular spar e transversely mounted, in it (as in my previous Patents), and extending outside the said fuselage edge F and forming part of the wing framework (constituted by the spare and a plurality of bearings,)and the wing sheets forming flying surfaces are able to slide on said frame.

The wing can comprise one single wing panel (as in US Patent 4,577,815) or two wing panels (as in US Patent 5,984,230). In Fig. 1 there is shown the panel a, namely the first wing panel close to the fuselage edge F, irrespective if it is the said single panel or the first of the two said panels.

The flying surface construction is shown in my US Pat.4,577,815 and each flying surface is made in the form of longitudinally extending wing sheets linked at their edges to form a box-like structure (not shown).

The assembly for driving the wing sheet a comprises a transverse rib p made of a plate of sheet of heavy gauge extending symmetrically to both sides of the spar, as can be seen in Fig. 1. The said plate p has a hole in its center to accomodate a tube section t, as in Figs.1, 2, 3.

The said hole being of a diameter corresponding to the outer diameter of the said tube section t which is welded all around its outer circumference to the said plate p as shown in Fig.2. The tube t has its inner diameter of a size to house the outer ring of the bearing k as in Figs. 1, 3, 4. (Retaining rings (not shown) within the tube t keep the bearing k in place).

The said bearing K being in turn of a bore corresponding to the outer diameter of the spar e as in Figs. 1, 3, 4, such that the said bearing is able to roll on the said spar e.

A power transmission means made of a sprocket S as can be seen in Figs.1, 3, 4 (the sprocket being of the flat type) and bored corresponding to the outer

diameter of the said tube t is welded to the said tube t (in the same manner as the said plate p) all around the tube circumference. S in Figs. 1, 3, 4 can be a sprocket or a timing pulley or a gear. The sprocket S (Or the timing pulley or the gear) being mounted maintaining a spanwise clearance between it and the plate p such that the sprocket S can mount a chain (or S mounting a timing belt) to be driven and function as a power transmission means. The sprocket S and the plate p can thus rotate about the spar e through the bearing k. A retaining ring (not shown) is mounted on the spar flanking the sprocket S to prevent the spanwise movement of the assembly.

A shaft rotatably mounted in the fuselage (not shown) and parallel to the spar axis E-E and extending out of the said fuselage, and rotated by an engine included in the fuselage (not shown), can mount a corresponding driver sprocket, or a driver timing pulley or a driver gear (not shown) and thus transmit rotation to the aforementioned sprocket or timing pulley S through a chain or a timing belt,and thus drive the transverse rib p to rotate about the spar e.

In case of S being a gear, the said shaft (not shown) is mounted closer to the spar e such that the driver gear mounted on the shaft can engage the gear S.

The said plate (transverse rib) p, as in Figs. 1, 3, 4 at its opposite ends mounts two longitudinally opposite spanwise ribs m made of tube or rod generally parallel to the spar axis E-E, their lenght being such to cover a portion of the wing sheets a.

At one of their tips the said spanwise ribs m are threaded (not shown) to be screwed in correspondent holes z of the plate p, as in Fig. 2(and secured with nuts (not shown)) also threaded.The said ribs m are thus symmetrically fixed to the plate p and are able to rotate about the spar e while the said plate p is rotating.

The said spanwise ribs m mount coaxially each one tube (sleeve) h of an inside diameter corresponding to their outer diameter, and of a lenght corresponding

to their lenght, such that the said tubes h can turn about the said ribs m about the common axis M as in Figs. 1, 4. Cotter pins (not shown) at the tips of the ribs m keep the tubes h in place.

As the tubes h extend longitudinally within a portion of the wing sheets, namely within a portion of the root wing panel a as in Figs. 1, 4, and are detached from the said wing sheets, they can undergo a limited rolling on the wing sheets a in the plane of the wing, (as caused by the relative movement between the wing sheets and the frame, without interfering with the said relative movement), while driving the wing sheets., as they rotate with the ribs m about the spar.

As illustrated in my previous Patents, while the spar e flexes and crosses its axis E-E as in Fig. 1, it reverses its curvature from e_x to e'_x relatively to the surface of the wing sheets, and the longitudinal and chordal edges a and g (the same letter for the wing panel a is used for the longitudinal edge for clarity) travel from positions a and g to positions a′ and g′ in the chordal plane-

For clarity, the relative movement perpendicularly to the plane of the wing, between the spanwise ribs or the tubes h and the wing sheets is not shown in Fig. 4 (the spar curvatures of flexion e_x and e'_x are the same as shown in Fig. 1.)

As can be seen in Fig. 3, the tubes (sleeves) h are of an outer diameter inferior to the distance between the opposite wing sheets (perpendicularly to the plane of the wing), such that they engage only one of the said opposite sheets a, and thus the said wing sheets can slide relatively to the said tubes h.

In case of a rotation direction opposite to that shown in Fig. 3, the tubes h engage only the sheet surfaces opposite to those shown in Fig. 3.

Fig 5 shows a modified assembly in which a side hub type sprocket S′ is bored corresponding to the outer diameter of the bearing k to house the said bearing, and ribs (made of rods or tubes) m′ are bent at a square angle with their ends

mounted in opposite holes bored in the said sprocket and welded to it, as can be seen in Fig. 5. In the same fashion as in Figs. 1, 4, the ribs m′ mount the same coaxial tubes h capable of turning about them, about the common axis M′ and thus function as in the assembly of Figs. 1, 4, relatively to the wing sheets. The chordal distance between the rib means m and also their lenght to cover the wing sheets portion should be suitable for engaging the wing sheets and drive them for axial rotation, as can be seen in Fig. 1

The distance between the said opposite rib means m is to be inferior to the wing sheets chordal dimension such that during the wing sheets axial rotation, the said rib means keep clear from the wing sheets longitudinal edges as shown in Fig. 1, while the spar e has reached its maximum flexion, to permit the relative movement between the wing sheets and the frame.Also, as can be seen in Fig. 1, the transverse rib p is mounted such that a clearance is left between the said transverse rib p and the flying surface root edge g in order that said edge g can angle freely relatively to the said transverse rib p , to accomodate the relative movement between the wing sheets and the frame.

In the proximity of the fuselage edge F, as in Fig. 1, the spar e can be considered not deviating from its axis E-E. So this axis can be considered the axis of the said drive means S and of the said transverse rib p, which has fixed to it the spanwise ribs m.

So the spanwise ribs of Fig. 1 during rotation keep their axis M generally parallel to the spar axis E-E, and generally fixed relatively to the said axis , and thus they are independent from the spar flex. Thus the wing sheets during their aforementioned travel, undergo a limited movement relatively to the said generally fixed spanwise ribs in the chordal plane.

And, as the spar is stationary, and the spanwise ribs driving the wing sheets , being not fixed to the spar and not rotated by the spar, do not constitute part of the frame (and do not bring any contribution to the wing sheets structural

strenght) the transmission of rotation to the wing sheets is performed through a relative movement between ribs not fixed to the spar and the wing sheets, (though this relative movement is dependent by the relative movement between the wing sheets and the frame.)